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ATTACHMENT 3

REALTIME DATA SMOOTHED

As Of: Feb 22, 1991

DMSP REALTIME DATA SMOOTHED (RDS)

SPACECRAFT

FORMAT/DOWNLINK

S-10 SDS, EXCEPT IN FORWARD (PRE-RECORD) ORDER
 USE EXISTING S-BAND TRANSMITTERS
 KG-46 ENCRYPTED

S-11 THRU S-15 SAME AS S-10, EXCEPT AFTER ENCRYPTION,
 CONVERTED TO NRZ-M AND THEN RATE 1/2 VITERBI
 ENCODED (CONSTRAINT LENGTH 7)

S-16 THRU S-20 SAME AS S-11 THRU S-15, EXCEPT
 USES NEW TRANSMITTERS AT NEW TBD
 FREQUENCIES
NOTE: THE SDS FORMAT AND RDS DATA RATE
 FOR THESE SPACECRAFT ARE NOT THE
 SAME AS FOR PREVIOUS SPACECRAFT
 (SEE 5D-3 OLS CHANGES)

FIDS DATA SPECIFICATION

The RDS data stream is SDS prerecord data (see IS-YD-821 for complete description of the SDS data stream) which has been encrypted, encoded and transmitted to ground stations real time.

RDS Encoding

The SDS data from the encrypter is first converted to NRZ-M and then Rate-1/2 encoded (see Figure 1). The original RDS study presentation had the NRZ-L to NRZ-M conversion after the Viterbi encoder. Further research by Westinghouse and Harris determined that the maximum link margin was attained by converting before the Viterbi encoder.

NRZ-L to NRZ-M

The data coming from the encrypter is NRZ-L which is difficult to process when transmitted using BPSK. To simplify processing the NRZ-L data is converted to NRZ-M. With NRZ-M, a transition occurs only when a 1 is transmitted and no transition represents a 0.

Viterbi Rate 1/2 Encoder

The encrypted NRZ-M SDS prerecord data is Rate 1/2 encoded using an industry standard algorithm. The constraint length of the encoder is seven ($k = 7$). The generating functions are identified by denoting the "taps" of each convoluting function. The generating functions G0 and G1 are denoted as $G0 = 1111001$ (171,) and $G1 = 1011011$ (133,). G0 precedes G1 when transmitted. A block diagram of the encoder is shown in figure 2. For further clarification, the schematic for the NRZ-L to NRZ-M converter and the Viterbi encoder is shown in figure 3. The data leaves the encoder at 133100 bits per second (twice the SDS prerecord data rate) and is routed directly to the selected transmitter.

RDS DATA FLOW

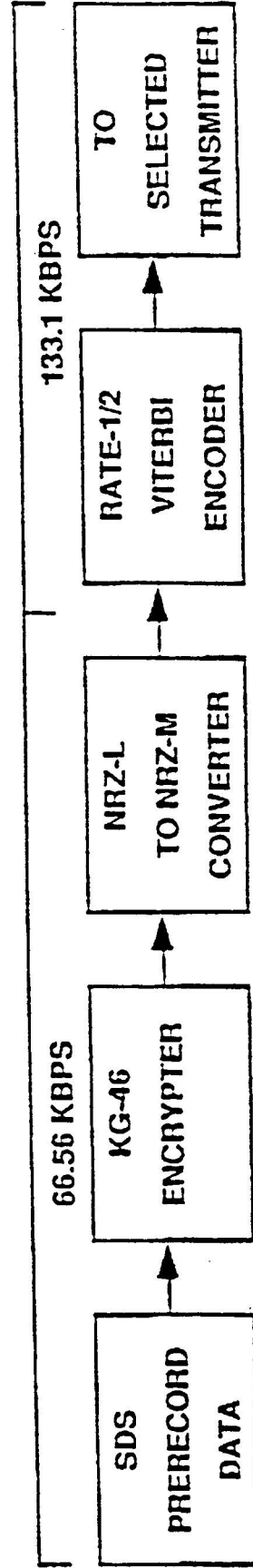


Figure 1

RATE 1/2 ENCODER

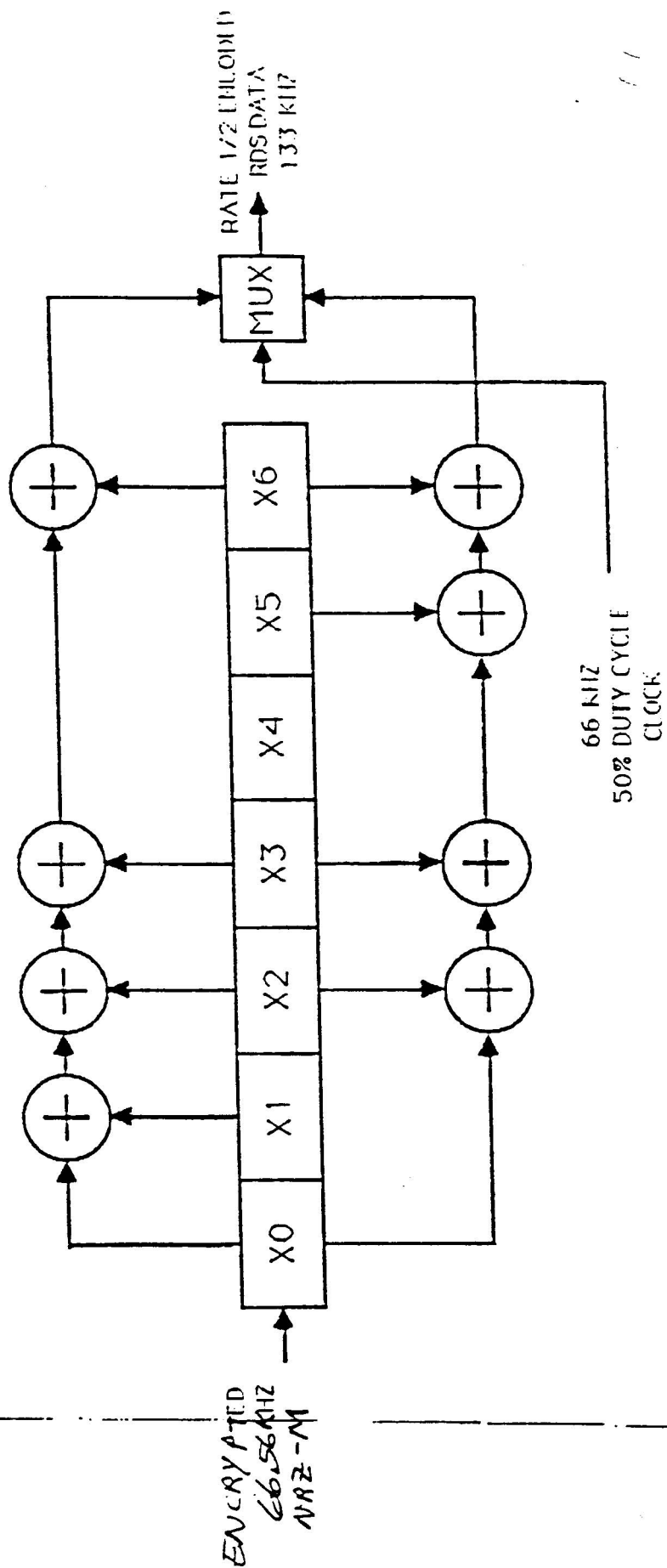


Figure 2

NRZ CONVERTER & RATE 1/2 ENCODER

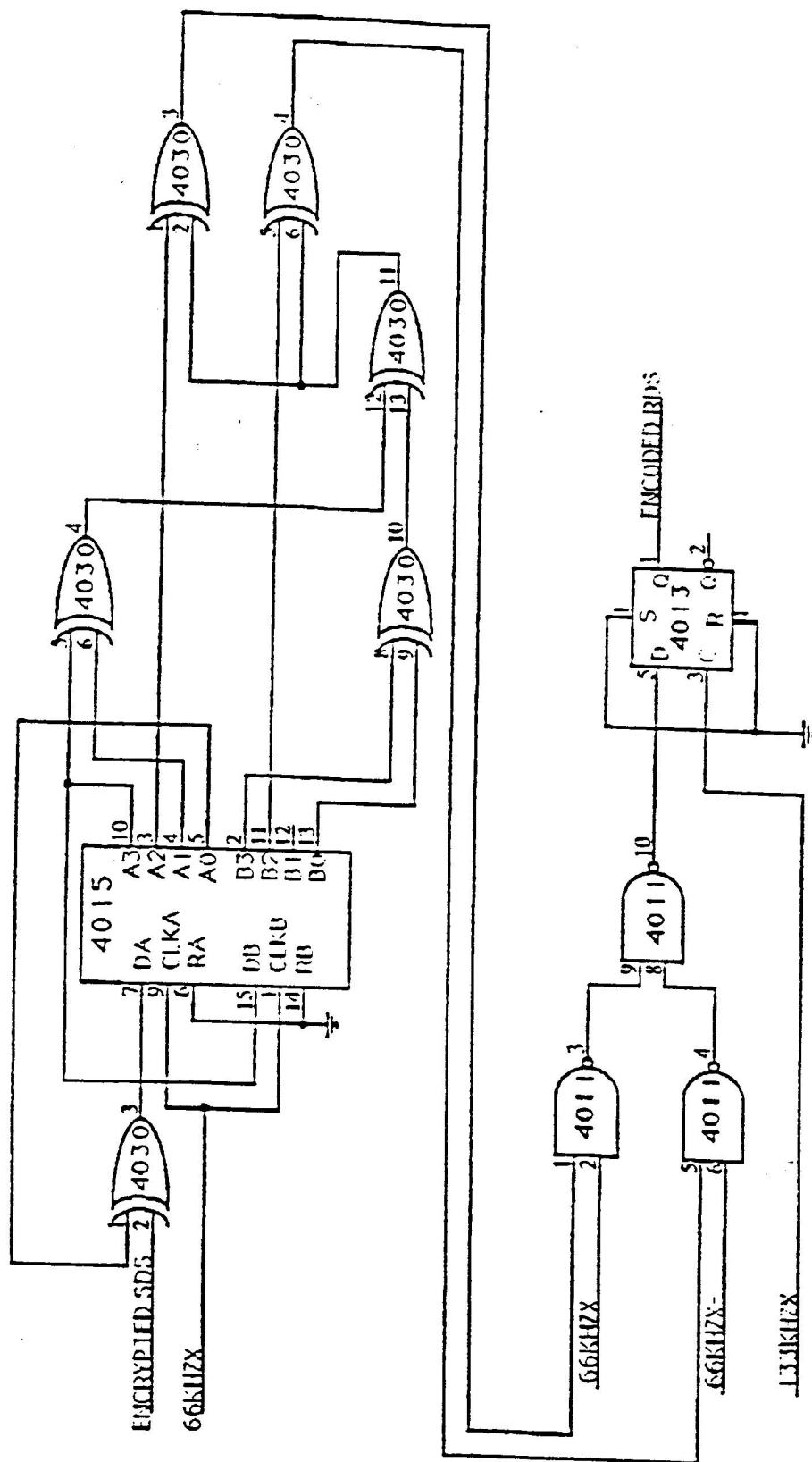
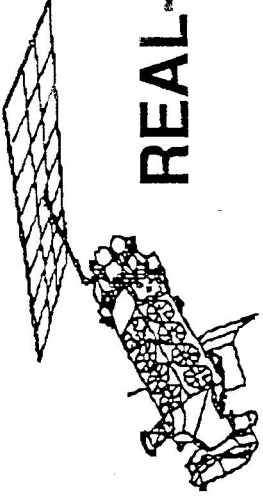


Figure 3

RUS Downlink Formats

OLS	8-11	7	12-16	17-21	17-21(?)	17-21(?)
Spacecraft	F6-F9	F-10	S11-S15	S16-S20	S16-S20(?)	S16-S20(?)
Status	Launched	Launched	Storage or S/C Test	OLS Assembly	Proposed SC/LC Sequential	Proposed SC/LC Packetized
Format Type	N/A	TDM	TDM	TDM	TDM	Packet
Downlink Bit Rate (Kps)	N/A	66.56	133.12	177.5	177.5	266.2
Downlink Data Rate (Kbps)	N/A	66.56	66.56	88.75	88.75	133.1
Convolutional Encoding	N/A	No	Rate 1/2	Rate 1/2	Rate 1/2	Rate 1/2
Transmitters	N/A	3 S-band	3 S-band	4 S-band 2 UHF	4 S-band 2 UHF	4 S-band 2 UHF
Video Channels	N/A	LS & TS	LS & TS	LS & TS	LS & TS or SC & LC	LS, TS, SC, LC



REAL-TIME DATA SMOOTH (RDS)

- INSTALLED ON F-10 TO SUPPORT DESERT SHIELD
- F-11 CONFIGURATION MODIFIED TO INCLUDE
 - OLS Formatter redundancy
 - Error correction encoding
- CAPABILITY PER AWS INITIATIVE NOV 19, 1988
 - Low data rate allows small (<1000 lb) tactical terminals
 - Transmits existing OLS visible & IR "smooth" data (132 kbps rate)
 - Uses existing spacecraft transmitters (2.2 GHz) and antennas